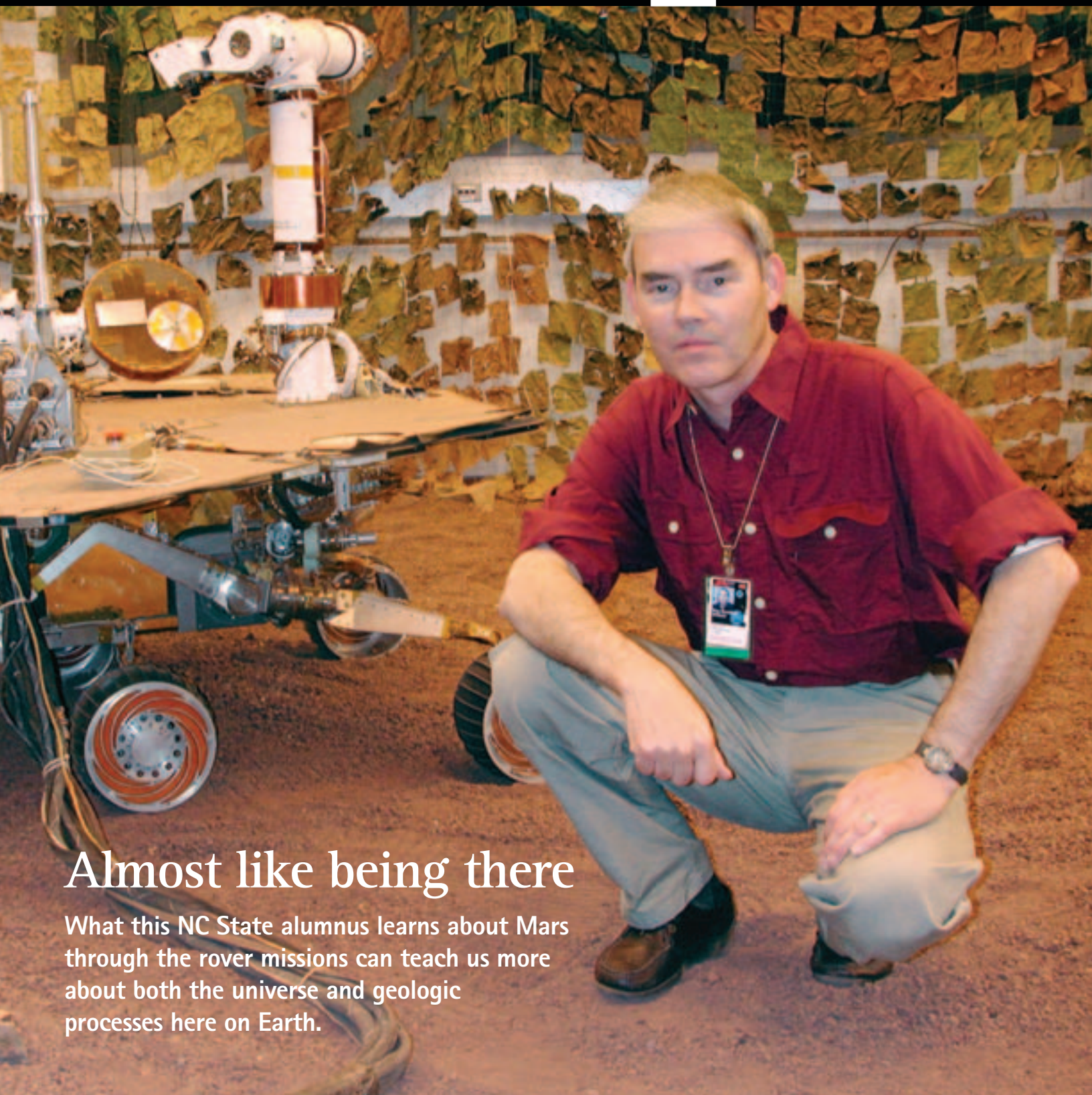


# scope

SPRING 2005

A LOOK INSIDE THE COLLEGE OF PHYSICAL AND MATHEMATICAL SCIENCES



## Almost like being there

What this NC State alumnus learns about Mars through the rover missions can teach us more about both the universe and geologic processes here on Earth.

# Today's undergraduates enjoy research opportunities

Most of our alumni and friends probably remember research being the exclusive domain of faculty and graduate students. In fact, it may have seemed mysterious because of the traditional separation of undergraduate study from the world of research.

This is no longer true, particularly at NC State. The College of Physical and Mathematical Sciences is a leader among its peers in providing research opportunities for undergraduates.

Just imagine how differently we all may have experienced our undergraduate years if we had been able to put into practice the concepts we learned in class. Perhaps it would have made class more interesting or relevant, and helped us master the information better. Perhaps it would have prepared us more effectively for the work environment after graduation, or even encouraged more of us to pursue advanced degrees.

Today's undergraduates experience all this and more. They work alongside faculty and graduate students in the laboratory and in the field. They are considered full-fledged members of research teams exploring cutting-edge topics such as nanotechnology and genomic science.

In some cases, they can take on their own research projects. For example, we have Statistics undergraduates examining data from the Environmental Protection Agency to identify and investigate suspicious trends. Meteorology undergraduates have access to tremendous amounts of data in the State Climate Office, where they work on research projects of

their own design and choosing.

The Statistics Department recently celebrated receiving an unprecedented second National Science Foundation VIGRE Grant (see page 10). VIGRE stands for Vertical Integration of Research and Education in the Mathematical Sciences, and its purpose is to broaden student education through vertically integrated teams of undergraduates, graduate students and postdoctoral trainees. This grant is a natural fit with the College's emphasis on undergraduate research.

The College also offers opportunities for undergraduates at other universities to get a taste of research through summer programs. One such program is a Research Experience for Undergraduates (REU) program offered by the Physics Department, now in its 19th year. The Chemistry Department has also offered a summer REU program for several years.

Another is the Industrial Mathematical and Statistical Modeling Workshop (see page 13). These programs are often the only exposure some undergraduates have to research.

Faculty and students agree that there are tremendous benefits to involving undergraduates in research. In addition to enriching their knowledge and laboratory skills, it provides opportunities for interacting with faculty outside the classroom, for working in teams and for improving their communications skills.

We hear story after story about how research adds an extra



PHOTO BY ROGER WINSTEAD

Dean Daniel L. Solomon

dimension to our students' university experience, and how it makes a key difference in student choice of career and advanced degree plans—and how undergraduates do make valuable contributions to our research projects.

The College is committed to finding innovative ways to improve the undergraduate educational experience and better prepare students for life and work. But perhaps the most profound way we achieve this is to let them play an important role in discovery while they're here.

A handwritten signature in dark ink that reads "Daniel L. Solomon".

Daniel L. Solomon, Dean

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# scope

A LOOK INSIDE THE COLLEGE OF

PHYSICAL AND MATHEMATICAL SCIENCES

SPRING 2005

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COURTESY OF KETRENA LANGHURST

KeTrena Langhurst amid stuffed animals collected for Toys for Tots.

## Cox Scholarship recipient succeeds through service to others

KeTrena Langhurst, a 2004 Phi Beta Kappa graduate with a double major in statistics and applied mathematics, is one of three national winners of the 2004 Gertrude Cox Scholarship for Women in Graduate Statistics Programs. The scholarship is sponsored by the American Statistical Association and the Caucus for Women in Statistics to encourage women seeking careers in statistics.

Named the outstanding senior scholar and valedictorian of her graduating class in statistics, Langhurst maintained a 4.0 average in honors programs in both majors while working 20 hours per week and volunteering in numerous charitable organizations on and off campus.

Langhurst was a recipient of an NSF traineeship through the Statistics Department's VIGRE (Vertical Integration of Research and Education) program, won a highly competitive Duke Energy Technology Scholarship, co-authored and presented research on air quality data analysis at the 2003 annual conference of the Air and Waste Management Association in San Diego, and is a member of numerous academic honors societies.

Now a first-year doctoral student

in statistics, Langhurst's outstanding academic performance is exceeded only by her extraordinary record of service to others.

As an officer of Gamma Beta Phi, an academic and service honors society, Langhurst started collection programs for Toys for Tots and for the Food Bank of North Carolina, successfully extending the food drive campus-wide to beat a challenge from the UNC-Chapel Hill chapter.

Her other volunteer work has included Adopt-a-Highway, fundraising for health advocacy groups such as Hospice of North Carolina, tutoring in Girls Club, mentoring freshmen facing health or academic difficulties, and doing stints with Habitat for Humanity—roofing is her specialty.

Langhurst's devotion to helping others and her decision to pursue a career in statistics arose from the same source: overcoming a history of domestic violence that left her family traumatized, fatherless and saddled with debt. Through family counseling, she became aware of victims' rights and laws against domestic abuse. She also learned how widespread and under-reported the problem is.

"Upon learning the statistics about domestic violence, I became interested

in where those statistics originated. I began focusing on mathematics, probability and statistics," she said.

Planning a career in social statistics, Langhurst is committed to volunteering at women's shelters, raising the awareness of abuse, and helping end domestic violence through community education and counseling.

"Life is not easy, but we do not have to make it alone. With the help of others, our individual struggles are made easier."

"I truly believe that I get more out of volunteering than those I'm helping," she said. "The joy on the kids' and the families' faces, or just the knowledge that I'm doing a good thing, makes me swell with pride and all the more eager to continue my work. That is exactly what I intend to do throughout my graduate career, and throughout my life."

The national Gertrude Cox Scholarship, offered to outstanding scholars entering or continuing graduate school in statistics, is named after the founder of the Statistics Department at NC State.

Last year, Susan Hunter (Statistics BS '03, MS '04) became the first NC State student to win the award.

# Stu Hunter is 2004 Distinguished Alumnus

J. Stuart "Stu" Hunter was recently named the 2004 Distinguished Alumnus for the College of Physical and Mathematical Sciences.

Hunter served in the Philippines during WWII. He later received his BS in Electrical Engineering in 1947 and his MS in Engineering Mathematics in 1949 from NC State. Then in 1954, he received his PhD in Experimental Statistics.

He joined the faculty of Princeton University in 1962 and is now Professor Emeritus, School of Engineering and Applied Science.

"Stu's record of achievements clearly reveals the tremendous impact he has had on the field of statistics," said Dean Daniel Solomon, himself a statistician. "He is perhaps most highly regarded as a leader in promoting the transfer of good statistical practice, notably the design of experiments and the tools of quality—from the textbook to the manufacturing floor—with dramatic impact on American industry and beyond. We are truly proud to add Stu to our list of Distinguished Alumnus award recipients."

Hunter was honored at a dinner hosted by the College, and recognized at the university-wide Alumni

Association Night of Stars awards gala. Several friends from his college days were able to attend and share in the festivities.

Hunter is the founding editor of *Technometrics*, a journal co-sponsored by the American Statistical Association (ASA) and the American Society for Quality (ASQ).

He has been a staff member of the National Academy of Sciences Committee on National Statistics, and chairman of the Advisory Board, Applied Mathematics, National Bureau of Standards.

Hunter is an emeritus editor of the John Wiley series on Probability and Statistics and a past member of the Technical Advisory Board of the US Golf Association. He has been a member of the board of directors of the Environmetrics Society since its inception in 1989.

While at Princeton, he was acknowledged as an outstanding lecturer. He also taught extensively outside of academia. In the 1960–70s his many industrial short courses earned him the nickname of "Johnny Appleseed" of industrial experimental design. He was the instructor in two TV continuing education programs produced by Westinghouse Learning.

He also lectured abroad at the Korean Standards Research Institute, the National Center for Industrial



PHOTO BY SALLY RAMEY

Classmates and close friends Woody Skillman, Stu Hunter, Harry Smith and Peggy Skillman enjoyed a reunion at the PAMS Distinguished Alumnus Award Dinner, held at the Cardinal Club in downtown Raleigh.

Science in China and at Ngee Ann Polytechnic, Singapore.

He is co-author of the text *Introductory Engineering Statistics* and of the book *Statistics for Experimenters*, 34th reprinting. A second edition of this popular text is scheduled to appear this spring.

Hunter has received many honors. He was President of the ASA in 1993 and in 1995 received the Association's highest honor, The Founder's Award.

He is a fellow of the ASA, ASQ, the Royal Statistical

Society and the American Association for the Advancement of Science.

He has received the S. S. Wilks Medal: US Army, Outstanding Statistician of the Year Award, the Deming Medal, the Shewhart Medal, the Ellis Ott Award and the Braumbaugh Award of the American Society for Quality (ASQ). He is an honorary member of the ASQ and a member of the Cosmos Club.

At 81, Hunter still continues as an active consultant to industry and government. He and his wife, Edna, reside in Hightstown, New Jersey.

Stu Hunter and Dean Solomon participated in the NC State Alumni Association's first Evening of Stars, a formal gala combining the university's recognition of college-level Distinguished Alumnus Awards and Alumni Association Award recipients.



PHOTO BY ROGER WINSTEAD



# Soft dinosaur tissue wows world

Conventional wisdom states that when dinosaur bones became fossilized, they were essentially transformed into rocks through a

from the femur of a 68-million-year-old *Tryannosaurus rex*. Not only is the tissue largely intact, it's still transparent and pliable. Microscopic structures resembling blood vessels and even cells are present.

All bone is made up of a combination of protein and other organic molecules and minerals. In modern bone, removing the minerals leaves supple, soft organic materials. In contrast, fossilized bone is supposed to be completely mineralized, meaning no organics are present. Dissolving the minerals from a fossilized bone, so the theory goes, would merely dissolve the entire fossil.

But the team was surprised when they removed the minerals from the *T. rex* femur fragment and found remaining stretchy bone matrix material that, when examined microscopically, seemed to show blood vessels and other recognizable organic features.

Since current data indicates that living birds are more closely related to dinosaurs than any other group, Schweitzer compared the findings from the *T. rex* with structures found in modern-day ostriches. Many of

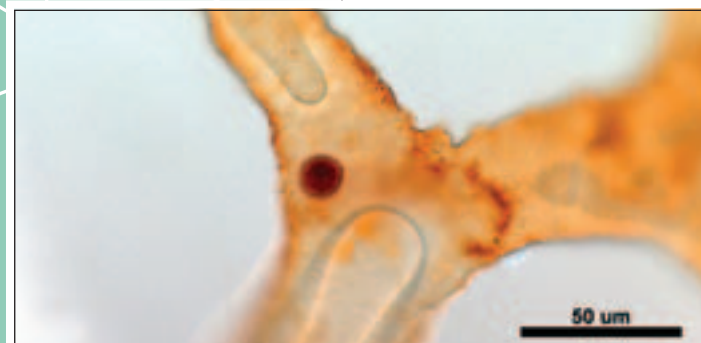
the small microstructures present in the *T. rex* sample appeared to be similar to the blood and bone cells from the ostrich sample.

Schweitzer then duplicated her findings with three other well-preserved dinosaur specimens, one 80-million-year-old hadrosaur and two 65-million-year-old tyrannosaurs. Each specimen had preserved vessels, cell-like structures, or flexible matrices that resembled bone collagen.

Current theories about fossil preservation hold that organic molecules should not preserve beyond 100,000 years. Schweitzer hopes further research will reveal exactly what the soft tissues are made of. Do they consist of original cells, and if so, do the cells still contain genetic information? Her early studies of the material suggest that at least some fragments of the dinosaurs' original molecular material may still be present.

"We may not really know as much about how fossils are preserved as we think," said Schweitzer.

The research was funded by NC State, the NC Museum of Natural Sciences and the National Science Foundation.



This amazing image shows what appears to be a dinosaur blood vessel, complete with what appears to be a red blood cell. Further research will tell us more.

gradual replacement of all organic material by minerals.

In an announcement that led to world-wide press coverage, an NC State researcher has turned that theory inside out.

Dr. Mary Schweitzer, assistant professor of paleontology with a joint appointment at the NC Museum of Natural Sciences, described in a paper published in the March 25 issue of *Science* how she and her technician, Jennifer Wittmeyer, isolated soft tissue

## Return to the Yangtze

Researchers from the Department of Marine, Earth and Atmospheric Sciences (MEAS) are following up on a 25-year-old Chinese research project concerning how humanity's actions impact important oceanic biogeochemical processes.

Professor Dave DeMaster was part of a 1980 research team that conducted the first US/Chinese coastal survey of the Yangtze River sediment plume in the East China Sea.

The Yangtze is Asia's largest river and the world's third longest. Its annual sediment load of 480 million tons, combined with the adjacent Yellow River's annual one billion tons, totals more than 10 percent of the global river sediment

discharge to the oceans.

"Our research indicated massive sediment deposition near the Yangtze's mouth during late spring and summer," DeMaster said. "Most of this material is resuspended and eventually carried southward by a coastal current as a result of intense winter storms, but how much sediment and how far it is transported southward are unknown."

In summer 2004, Paul Liu, assistant professor, conducted a geological survey with Chinese scientists from Ocean University of China and the Chinese Academy of Sciences. Liu brought along a new tool—the EdgeTech's Sub-bottom Profiler—which uses a high-resolution chirp



Paul Liu and Professor Guan Chenzhong pause for a portrait with a box corer, which captures a 1-meter-deep sample of seafloor sediment, that is then analyzed.

# Duck and chicken ancestors lived with dinosaurs

Paleontologist Dr. Julia A. Clarke, an assistant professor in the Department of Marine, Earth and Atmospheric Sciences, and her colleagues have unprecedented fossil proof that some close cousins to living bird species coexisted with dinosaurs more than 65 million years ago.

This is the first definitive fossil proof linking close relatives of living birds to a time when dinosaurs roamed the earth. The research is published in the Jan. 20 edition of the scientific journal *Nature*.

Information from a new avian species, *Vegavis iaai*, shows that these birds lived in the Cretaceous period and must have survived the Cretaceous/Tertiary (K/T) mass extinction event that included the disappearance of all other dinosaurs about 65 million years ago.

Analysis of fresh evidence from computed tomography (CT) scans of the fossil—which uncovered new

bones deep within the rock matrix—and recovery of latex peels made of the specimen just after its discovery in Antarctica in 1992 revealed its importance to avian evolution and that it represented a new species within the group *Anseriformes*, which includes ducks and geese.

The question of whether relatives of living birds existed alongside non-bird dinosaurs has evoked intense controversy in scientific circles. Some scholars conclude that relatives of living birds must have existed alongside non-avian dinosaurs and survived the mass extinction of dinosaurs at the K/T boundary. Until the discovery of *Vegavis*, fossil data to support this hypothesis was weak at best.

Other scientists have claimed this limited previous data was unreliable and that the fossil record showed no evidence of living bird lineages in the Cretaceous. In a "big bang" theory of bird evolution, these scientists have proposed that relatives of today's



A reconstruction by well-known dinosaur artist Michael Skrepnick shows *Vegavis* in the immediate foreground with a duckbill dinosaur (hadrosaur) in the background.

birds came on the scene only after non-avian dinosaurs became extinct at the K/T boundary.

"We have more data than ever to propose at least the beginnings of the radiation of all living birds in the Cretaceous," Clarke says. "We now know that duck and chicken relatives coexisted with non-avian dinosaurs. This does not mean that today's chicken and duck species lived with non-avian dinosaurs, but that the

evolutionary lineages leading to today's duck and chicken species did."

Clarke will now continue her search for more clues to the evolution of birds.

"Looking to the Cretaceous for more parts of extant avian radiation is essential," she said.

Funding for the research came from the NSF Office of Polar Programs Small Grant for Experimental Research.

sonar system to map the seafloor, detect thicknesses and sequences of mud and sand deposits, and reveal sea-level and depositional histories.

Large river-dominated ocean margins are important not only because of their tremendous sediment input, but also because of their nutrient inputs to the ocean, their coastal biological food webs, and their response to physical changes caused by human activity.

For example, a significant amount of atmospheric carbon dioxide (CO<sub>2</sub>) released by burning fossil fuel is removed by vegetation and weathering processes, and subsequently transported to the ocean by rivers. The East China Sea is a large carbon sink, absorbing a significant amount of atmospheric CO<sub>2</sub>.

This may change once the Three-Gorge Dam, the world's largest dam, is completed on the Yangtze in 2009. This project will cause environmental and ecological changes on land, and could also create significant impacts on the East China Sea's oceanographic biogeochemical systems. The dam's impact on coastal sedimentation, coastal food webs, circulation and estuarine biogeochemistry is unknown at this time.

"Before we can determine what those impacts may be, we must understand how much CO<sub>2</sub> could be buried there as organic matter, how much atmospheric CO<sub>2</sub> has been absorbed by the water column, and what the impacts and consequences of current human activities are on land and in the ocean," DeMaster said.

"We also need to understand the deposition and relocation of sediment on the continental shelf, and how biogeochemical processes in coastal waters are affected by regional oceanographic processes such as winds, ocean currents and typhoons."

Initial 2004 results show a huge wedge of muddy Yangtze sediment has been transported by a seasonal coastal current and deposited on the East China Sea's inner shelf. More research will follow, supported by the National Science Foundation, the Chinese National Science Foundation, the Office of Naval Research, NC State's Faculty and Professional Development Fund and NC State International Seed Grants.

Visit [www4.ncsu.edu/~jpliu/](http://www4.ncsu.edu/~jpliu/) for more information.





The new PAMS Web site includes banners of black with bright graphics and various formulas floating in the background.

## PAMS launches new Web site

If you visit [www.pams.ncsu.edu](http://www.pams.ncsu.edu) on the Internet, you'll find a new and dramatically different Web site for the College of Physical and Mathematical Sciences.

The new Web site includes updates and improvements determined by a communications audit performed by Sally Ramey, director of college relations. Compared with the sites of peer institutions, the audit revealed that PAMS' original site was superior in terms of content, but could leap ahead with appearance and navigational improvements.

Mark Brooks (BS Meteorology '03), a meteorologist with the State Climate Office (SCO) on NC State's campus, is heavily involved in development of

Web-based functions that share the SCO's data with the public. He also serves as the PAMS "Webmaster" and built the new Web site from scratch.

The new architecture of the site helps users better locate the information they need. The site's functionalities provide more effective linkages with other sites and more interesting presentation of information. The new design better represents the College's variety of high-tech, cutting-edge science, and ties closely with the College's print materials.

Still more functions and features will be added in the future.

"A Web site continually changes as better ideas emerge and new technologies develop," Ramey said.

"We've added a 'hot button' on the front page to direct users to timely announcements. We are developing an online giving form, a new calendar function, and much more."

Brooks also is working with PAMS departments to upgrade their Web sites. The eventual goal is for the College and each of its departments to have sites that look and function as an effective "family."

"The Web is now the primary way prospective students, graduate students, faculty and the community learn about a university," Ramey said. "It is important to have an attractive and dynamic site."



# Chemists receive \$1 million Keck Foundation grant

North Carolina State University announced receipt of a \$1 million gift from the W.M. Keck Foundation to further research on RNA-mediated evolutionary materials chemistry. This new field will influence advances in other fields such as materials science, nanotechnology and biotechnology.

The grant will help support the ongoing work of Dr. Daniel Feldheim, associate professor of chemistry, Dr. Bruce Eaton, professor of chemistry, and Dr. Stefan Franzen, associate professor of chemistry, who have shown that the biological molecule RNA can be used to assemble nanoparticle materials, which are particles less than one billionth of a meter in size.

"Ribonucleic acid (RNA) molecules are part of nature's blueprint for synthesizing other molecules," Feldheim said. "We're working to harness RNA's ability to catalyze reactions, and use it to develop new inorganic materials."

Feldheim and Eaton developed a technique to coax specific sequences of lab-manufactured RNA into building inorganic materials, essentially "harnessing evolution in a beaker." They published their findings in the April 16, 2004 edition of *Science*.

The Keck grant will support the professors' further exploration of using RNA to create new classes of nanoparticle materials with specific desired properties, such as hydrogen

production. If RNA can create new materials that produce significant amounts of hydrogen, these materials may lead to development of alternative energy sources.

The grant also will help support an NC State center for evolutionary chemistry that is in the process of being established.

"The Keck Foundation is recognized for its leadership in driving the creation of new knowledge," said Daniel Solomon, dean of the College of Physical and Mathematical Sciences. "We are excited to receive its support of our chemists' work in the new field of evolutionary materials chemistry."

# Tsiatis named Drexel Professor

Anastasios "Butch" A. Tsiatis, PhD, has been named Drexel Professor of Statistics at North Carolina State University. His honor was recently celebrated with a reception hosted by the Department of Statistics and the College of Physical and Mathematical Sciences.

Tsiatis received his BS in mathematics from MIT in 1970 and his PhD in statistics from the University of California at Berkeley in 1974. He joined the NC State Department

of Statistics in 1997.

He is known internationally for his biostatistics research, specifically in the areas of survival analysis, clinical trials, surrogate markers, cost of care and quality of life, among others. His expertise is frequently sought by medical research centers.

Tsiatis has published more than 125 papers and given more than 150 invited seminars. He has been successful in obtaining major grant funding from the National Institutes of Health (NIH) for his research, including an NIH MERIT award, which provides up to 10 years of support. He also is involved with a recent \$800,000 grant to establish a summer institute for training in biostatistics.

He is a Fellow of the American Statistical Association and of the Institute of Mathematical Statistics.

He has been associate editor of three leading statistics journals and an editor of the Springer-Verlag book series, *Statistics for Biology and Health*. He also has been very active

in the professional societies.

Tsiatis is an outstanding researcher, teacher and mentor, having been named an Alumni Distinguished Research Professor in 2003. He has developed several new courses, and they are among the most popular courses with statistics graduate students.

He has held positions at the University of Wisconsin Department of Statistics and Preventive Medicine, the Harvard School of Public Health, St. Jude Children's Research Hospital, and the Dana Farber Cancer Institute. He has been a consulting statistician for the World Health Organization. Dr. Tsiatis is an adjunct professor with Duke University's Department of Biostatistics and Bioinformatics and a member of the Lineberger Comprehensive Cancer Center at UNC-Chapel Hill.

Tsiatis joins PAMS' other three Drexel professors—H.T. Banks and Tim Kelley in Mathematics, and Jerry Bernholz in Physics.

## Faculty/Staff Notables

**Viney P. Aneja** (MEAS)—Member, EPA Science Advisory Board Environmental Engineering Committee

**David E. Aspnes** (Physics)—Fellow of the World Innovation Foundation

**H. Thomas Banks** (Mathematics)—Turkish Governor's Medal of Honor Award for Outstanding Research Contributions

**Marco Bongiorno-Nardelli** (Physics)—Sigma Xi Faculty Research Award

**Marcia L. Gumpertz** (Statistics)—President, National Mu Sigma Rho Honorary Society

**T. Brent Gunnoe** (Chemistry)—Sigma Xi Faculty Research Award

**Hoon Hong** (Mathematics)—Academy of Outstanding Teachers

**Paul A. Maggard** (Chemistry)—Beckman Young Investigator Award

**Carla Mattos** (Molecular & Structural Biochemistry)—2003 NSF Presidential Early Career Award for Scientists and Engineers (PECASE)

**Kailash C. Misra** (Mathematics)—Academy of Outstanding Teachers

**Larry K. Norris** (Mathematics)—LeRoy and Elva Martin Award for Teaching Excellence

**Thomas P. Pearl** (Physics)—ORAU Ralph E. Powe Junior Enhancement Award

**Charles Proctor** (Statistics-emeritus)—ASTM International Harold F. Dodge Award

**L. Worth Seagondollar** (Physics-emeritus)—Shared personal experiences on "The First Man-made Nuclear Explosion" at Sigma Pi Sigma's 2004 summer congress in New Mexico.

PHOTO BY ROGER WINSTEAD



Anastasios "Butch" A. Tsiatis

# Almost like being there

Since he was a child, Dr. Larry Crumpler has been interested in other planets. So interested that he decided to major in physics at NC State, hoping that would lead him to outer space. Realizing that it was the geology of other worlds that most intrigued him, he changed his major to geology and graduated in 1973.

While he was an undergraduate, NASA began reaching out to Mars, sending flyby spacecraft to get the best possible pictures of Earth's next-door neighbor. The images were fuzzy, but they showed valleys and volcanoes, which became Crumpler's chief interest in graduate school at the University of New Mexico and the University of Arizona.

Today, Crumpler is a research curator for the New Mexico Museum of Natural History and Science. He spends much of his time studying the plentiful, young volcanoes in his home state. Sometimes he branches out to volcanoes on other planets. He has catalogued volcanoes on Venus, mapped eruptions on Mars and studied all manner of formations on Earth—his research leading him into space and back again.

Crumpler also is a field geologist—someone who goes out into the field and attempts to understand the geological history of an area by examining the rocks and studying the landscape's development. The job involves a lot of walking, mapping, photography and even hammering open rocks to study the grain structure inside.

Crumpler was immediately interested when he heard about a 2004 space mission featuring "robotic field

geologists"—machines that would carry most of the same equipment he carries when he's mapping out a new territory. They would even be equipped with small grinders for boring into rocks, exposing the interiors for analysis back home.

Intrigued, Crumpler applied to participate in this great adventure—

its rugged wheels began to roll forward, Crumpler felt like he was rolling forward, too—that his own dusty boots were tramping across the Red Planet's tricky terrain.

"We were moving across the surface, taking in these big panoramas every day," said Crumpler. "It was like doing a great, big, natural history of

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*"It was true geographic exploration. No one's done that for 100 years. We were Lewis and Clark, marching across plains, seeing new stuff every day."*

*— Larry Crumpler*

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Spirit took this 360-degree panorama of the Columbia Hills in August 2004. The rocks here show evidence of past alteration by water. The dark patch of soil to the right is where Spirit stopped for engineering work on its right front wheel. Spirit's tracks can be followed from there back toward Bonneville Crater and its original landing site, almost two miles away.

This approximate true-color image consists of 470 images acquired through six panoramic camera filters. Several weeks of image processing and geometric mapping at Jet Propulsion Laboratory, Pasadena, CA, and Cornell University, Ithaca, NY, were required to stitch all the images together into this spectacular mosaic.

NASA's Mars Rover mission—and was one of only 28 scientists chosen.

For the past few years, he met with other scientists to select landing sites for rovers Spirit and Opportunity from more than 200 possibilities.

In January 2004, Crumpler reported to the Jet Propulsion Laboratory in Pasadena, California. He adjusted to "Mars time" with the rest of the mission staff so they could synchronize their work with the Mars solar day.

Along with other mission personnel, Crumpler watched as more than 300 million miles away, the rover Spirit landed, unpacked itself, stood up and looked around. The interior of Mars' Gusev Crater came into view.

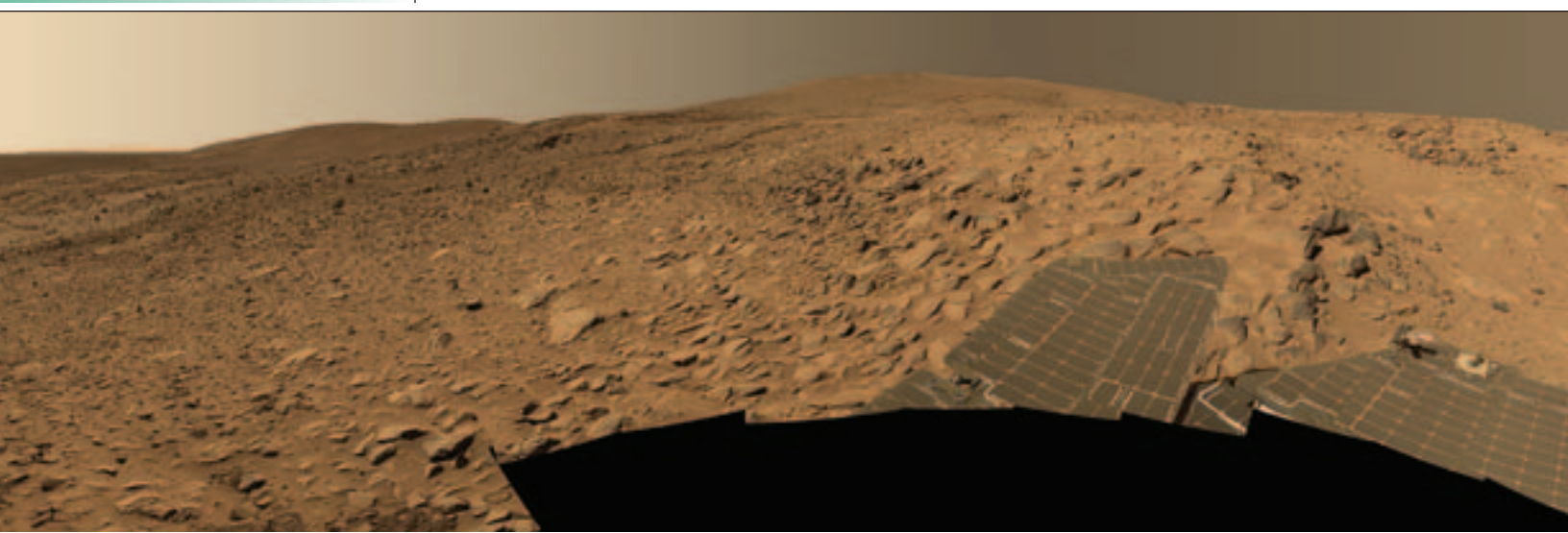
Several days later, Spirit was ready to move across the crater, and when

another planet. It was true geographic exploration. No one's done that for 100 years. We were Lewis and Clark, marching across plains, seeing new stuff every day."

The stuff Crumpler and other scientists saw included strange rocks with long, flutelike grooves, wind-blown sand dunes and rocks dotted with tiny gas bubbles.

The mission's overarching goal is to determine whether Mars was ever able to support life. On Earth, where there's water, there's life, so scientists want to determine if Mars once held an ocean, or if it has always been as dry as it is today. To find out, scientists focus on the planet's geology—dry riverbeds and rocks that form only when water is present.

The nature and reasons for the





formations will be analyzed for years to come. Meanwhile, the data is giving scientists new ideas about their studies back on Earth.

"You are forced to ask questions, when you look at alien environments, that you never ask here," he said.

"There are things here you always take for granted, like the significance of gas bubbles in a lava flow," he said. "They're there. It's gas, and it makes a bubble. But on another planet it occurs to you: 'Maybe I can use that to tell something about the atmosphere, whether it was thick or whether it was thin.' Then you come back to Earth and say, 'Well, what do we know about lava flows and gas bubbles?' It turns out you don't know a lot, so you go out and start learning something new. Every time you look at something on another planet, the same thing happens."

More research is to come, but early findings *have* shown evidence of water, Crumpler said.

The Mars day, or "sol," is 37 minutes longer than an Earth day, so it didn't take long for the science team to become out of synch with their home planet. A work crew blacked out the windows on the lab's Mars wing. The scientists even wore watches that kept time for 24-hour, 37-minute days.

"We didn't want to do anything on Earth time," Crumpler said.

Because Opportunity and Spirit were on opposite sides of Mars, the work shifts were split in two and most scientists were to track the same rover for the 90 sols, or 92.3 Earth days, that made up the primary mission.

Crumpler stuck with Spirit, helping plan the route that led the golf cart-sized rover up to the rim of Gusev Crater, and then toward a formation

keep track of where they've been and where they're going.

Crumpler named the Sandia Manzano Mountains after a chain in

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*"Now that little dot is a real place," he said. "It's not just some science-fictional planet. It's a real place, and you've actually stood there and looked across the surface and seen the smallest pebble."*

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*— Larry Crumpler*

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now known as the Columbia Hills, named in memory of space shuttle Columbia. He made maps, made observations and, based on what the rover was doing or seeing, helped decide what it would do next.

The landscape on Mars is different, obviously, from the landscape here on Earth. But Crumpler saw much in common with his home in New Mexico—so did other scientists, who told him he was the only one who got homesick looking at Mars every day. He saw similarities with other regions, too. The porous red rocks reminded Crumpler and other scientists of the red rocks in North Carolina. The Bonneville Crater reminded them of prehistoric Utah. Thus, they named a number of formations after places on Earth.

"I guess I've named more than most," said Crumpler. The names are unofficial, mostly to let researchers

Albuquerque, NM. He named Laguna Hollow after a high school back home. He also gave Mars its own Route 66, an angular rock near the Bonneville Crater that marked the beginning of Spirit's trek across the plains.

Crumpler remembers walking into the lab soon after the end of the primary mission, and feeling like everything was different. The boards had been taken off the windows and the scientists could see out again.

"You could see mountains and sunlight. It was almost like spring, and we were coming back to Earth."

But not all of the way back, at least not yet.

The rovers kept going, lasting more than three times as long as planned, and are showing few signs of wearing out. They even made it through a critical two-week period when communications were disrupted as Mars' orbit took it behind the sun.

"At this point, some of the office furniture is wearing out faster than the rovers are," Crumpler said.

At press time, both Spirit and Opportunity were still in excellent health, passing their 415th and 388th Martian sols respectively. It is unknown just how long these tough explorers will last.

Mission scientists continue their work on the extended mission from home via computer connections, keeping the process economical. Only a few members work together at a time. They will continue gathering as much information as they can before the rovers eventually break down in the harsh environment.

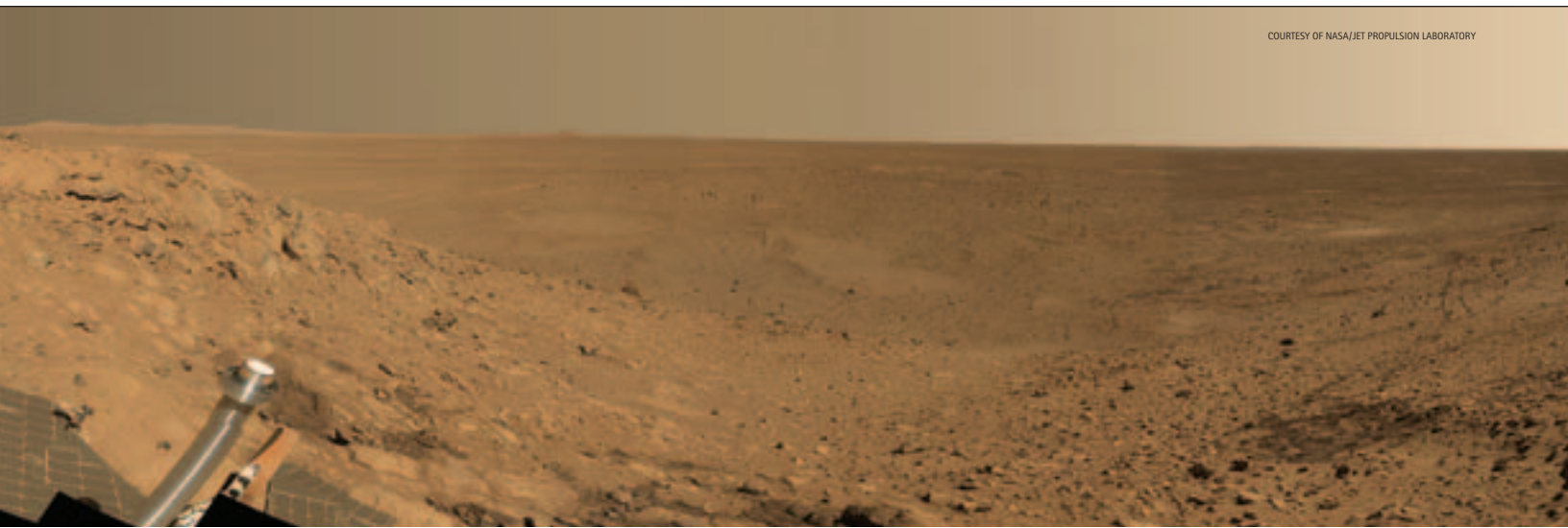
Crumpler will stay involved through the project's duration, though no one is sure how long that will be.

These days, when Crumpler looks up and sees Mars twinkling in the night sky, he thinks of it as someplace he's been.

"Now that little dot is a real place," he said. "It's not just some science-fictional planet. It's a real place, and you've actually stood there and looked across the surface and seen the smallest pebble. You've actually walked across it and seen the landscape change."

*Adapted from Madelyn Rosenberg Lazorchak's story in the Fall 2004 State, the NC State Alumni Association's quarterly magazine.*

COURTESY OF NASA/JET PROPULSION LABORATORY



# Statistics Department celebrates second VIGRE grant

For an unprecedented second time, the Department of Statistics has been awarded the National Science Foundation's (NSF) prestigious VIGRE Grant. The \$1.59 million grant award was announced last summer at a departmental reception with special guests Congressman David Price and William Rundell of the NSF.

The department is only one of three selected nationwide to receive a second VIGRE Grant, and the only pure statistics department to do so.

VIGRE stands for Vertical Integration of Research and Education in the Mathematical Sciences. The grant provides funding for programs that broaden student education through vertically integrated teams of undergraduates, graduate students and postdoctoral trainees.

These teams work together in workgroups in biostatistics, environmental statistics, statistical genetics, bioinformatics and other areas.

"As its acronym implies, the first VIGRE grant helped us to build upon our already successful program by creating more *vigorous* opportunities for our students," said Sastry Pantula, department head. "VIGRE enabled us to enhance student mentoring and provide traineeships. The traineeships are important to economic development by providing a skilled workforce, and result from successful public-



Congressman David Price addresses a packed room at the Statistics Department's VIGRE Grant celebration. Seated facing the audience are Sastry Pantula, department head; Jim Oblinger, then provost; William Rundell, director of NSF's Division of Mathematical Sciences and Robert Barnhardt, then interim chancellor.

mentoring and recruitment programs.

Price congratulated the department for its achievement, but reminded the audience that the current federal budget for scientific research is "not good enough."

"On the one hand, we cannot fail to savor this accomplishment," he said. "But we celebrate in the midst of a huge national challenge. We need to do better." He cited trends indicating

- The projected result is that the US will face a serious shortage of mathematical scientists. This is critical because advances in technology, and in the basic physical and biological sciences, rely heavily on the mathematical sciences and on the participation of mathematical scientists. Homeland security is an example of a new field dependent on mathematics.

- Student support in the mathematical sciences is about 1/3 of that in the biological sciences and physical sciences.

"And there's a disturbing statement from the National Academy's Odom Report—based on present trends, it is *unlikely that the US will be able to maintain its world leadership in the mathematical sciences*," Price said. "A national pool of well trained mathematical scientists is essential for academia, industry and government."

William Rundell, director of the NSF's Division of Mathematical Sciences, echoed this information and described the specific difficulties faced by NSF in providing support for the mathematical sciences.

This was not always the case; the physical and mathematical sciences received the bulk of federal research funding after World War II and during the Cold War. However, in recent years, the relative level of funding for these disciplines has decreased.

Rundell cited China's focus on the mathematical sciences, which places that nation in a position to achieve international leadership in these areas.

"It makes perfect sense," he said. "If you're to choose one field of science, choose the central one."

The VIGRE grants arose when, faced with a slim budget for the mathematical sciences, NSF made a bold decision to focus its resources on two areas for maximum impact—one being the formation of connections with other disciplines, and the other, an investment in education.

"Training young people is the key to the future," he said. "Through the VIGRE Grant, we wanted departments like yours to revamp and rethink their curriculum, to change the landscape. We wanted to see change, not the funding of old things. We wanted to see who is making progress in making a difference. Clearly, this department does."

*"We wanted to see who is making progress in making a difference. Clearly, this department does."*

— William Rundell

private partnerships for which NC State is so well known."

The department took the grant a step further by expanding student services to include interdisciplinary workshops, professional skills workshops, supervised consulting classes, undergraduate summer research experiences, and other activities in which all students can participate.

The department will use this second VIGRE grant to expand its

that the US is losing ground in maintaining its international leadership in the mathematical sciences:

- Enrollment is decreasing in mathematical sciences at the undergraduate and graduate levels. Fewer non-US students are coming to the US to study. Of those who do come, more return to their home nation to work.



# Trustees see PAMS in 3-D

To maintain its awareness of campus programs, the NC State Board of Trustees requests that university colleges periodically host its meetings. This provides each college with an opportunity to update the trustees on recent achievements, new programs and trends within the college.

The College of Physical and Mathematical Sciences hosted a recent meeting of the trustees in the Marye Anne Fox Undergraduate Science Teaching Laboratory building. In addition to showcasing the new facility, the College provided faculty presentations about innovative instructional methods and technologies.

Maria Oliver-Hoyo, assistant professor of chemistry, presented information on SCALE-UP, or Student Centered Activities for Large Enrollment Undergraduate Programs. Developed in the Physics Department, SCALE-UP has been adapted for introductory chemistry courses. The program has been shown to produce improvements in student performance, particularly that of females and minorities, in both chemistry and physics courses.

Ruth Chabay and Bruce Sherwood, both physics professors specializing in physics education research, discussed their "Matter and



Members of the NC State Board of Trustees and other meeting attendees use 3-D glasses to see the full effect of the 3-D simulation in the physics presentation.

Interactions" textbook and curriculum. A dramatic shift in content compared to traditional introductory physics courses, their approach emphasizes concepts rather than formulas.

A special feature of the new curriculum is the use of 3-D video to help students better visualize basic interactions, such as the behavior of an object and its magnetic field as the object moves through space.

## Denise Hubbard joins Development staff

The College recently welcomed Denise Malloy Hubbard as director of development in the Office of Development and College Relations.

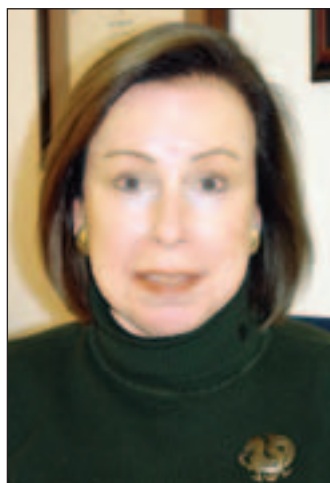
Hubbard is a 1985 NC State graduate with a BA in Psychology. She received her master's in liberal studies from the University of North Carolina at Wilmington in 2001.

Along with a wealth of skills and enthusiasm, she brings to her position

more than 17 years' experience in not-for-profit management, development and volunteer coordination.

Hubbard has served as managing director of Raleigh's Theatre in the Park and executive director of Theatre Charlotte.

Her most recent position was development coordinator at Cape Fear Museum in Wilmington, NC.



Denise Malloy Hubbard

## Math Department history on Web

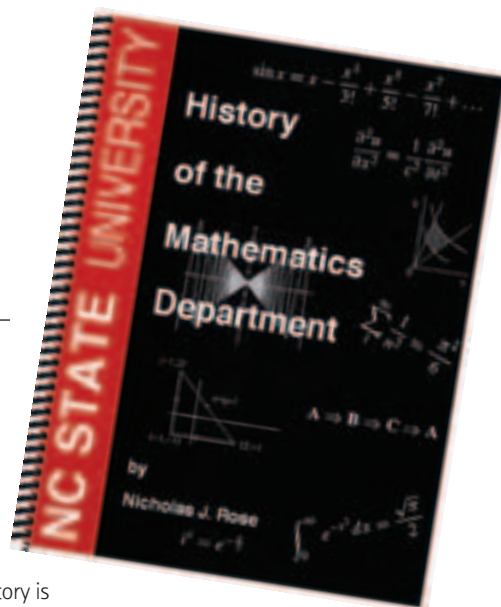
Nicholas J. Rose, professor emeritus of mathematics and former department head, has compiled a complete history of the NC State Department of Mathematics.

The document features numerous photos, personal insights, frank discussions about social and policy issues, departmental folklore and even a little inside humor.

The work pays tribute to the many faculty and staff members who

played a role in the growth and evolution of the department.

To read the history, visit [www.math.ncsu.edu](http://www.math.ncsu.edu) and click on "History of the Department" under "Department Life" in the left column. The online history is divided into various categories for easy reference, and is also available as an 89-page PDF document.



## PAMS Alumni & Friends Weekend



### Mark your calendar now: September 23–24, 2005

Join your fellow alumni for a special College of Physical and Mathematical Sciences Alumni & Friends Weekend, Sept. 23–24! Scheduled to coincide with the NC State–Carolina football game, the weekend offers something for everyone, including:

- A Friday luncheon with fellow alumni in the beautiful, three-story atrium of our new laboratory building!
- Afternoon "classes" with faculty. Choose your class schedule from a variety of popular science topics!
- Friday night social with music and food! A drawing will be held for a pair of NC State–Carolina football game tickets. You must be present to win!
- Saturday game-time gathering at Chuck'em, a restaurant and sports bar named for NC State football coach Chuck Amato!
- Door prize drawings throughout the weekend!

**All alumni will receive more details about online registration this summer.**

**But if you want to reserve your spot now, just call us at 919-515-3462 or e-mail us at [pamsalumni@lists.ncsu.edu](mailto:pamsalumni@lists.ncsu.edu).**



# Graduate students tackle real-world problems at workshop

"One person cannot do everything."

"Learn from each other and work as a team."

"It helps when you have an idea for people to tell you that you're right, or you're crazy."

These are examples of what students learned during NC State's 10th annual Industrial Mathematical and Statistical Modeling Workshop for graduate students.

A group of 30 graduate students from 20 universities in the United States and Mexico spent a week on campus last summer, working hard to improve communications between spacecraft, and optimize the mobile sensing technology for biological and chemical agents in the atmosphere.

These complex issues were just two of the real-world problems featured in the workshop, widely considered one of the premier modeling workshops for students.

Hosted by NC State's Center for Research in Scientific Computation (CRSC) and the Department of Mathematics, the program has been

Centers for Health Research, and the Air Force Research Laboratory-Kirkland Air Force Base.

"These problems are very complex versions of the 'word problems' you may remember from your grade school math classes," said Negash Medhin, professor of mathematics. "The difference here, of course, is that solving these problems can actually lead to a partial or complete answer to a real-world challenge."

For example, the MIT Lincoln Laboratory sought to develop a network of sensors that can detect airborne biological or chemical agents. It was believed that mobile sensors would be more effective than stationary sensors because their movement would provide more opportunities to encounter the plume of an airborne agent. But how many mobile sensors would be needed to monitor a given area, compared to stationary ones?

This is an important question because the sensors are expensive. The student group was charged with determining the number of mobile or fixed sensors needed in a network,



Participants in this workshop group, shown with Michael Horton of Lincoln Laboratory (back row, no hat), determined that there were no benefits to having a system of mobile airborne contaminant sensors over stationary sensors.

pressure in a sealed chamber containing an unrestrained animal.

On the workshop's first day, the students are divided into teams led by a research scientist-mentor from the laboratory whose problem they will work to solve. One or two NC State faculty members are also assigned to each team. The team members have 10 days to work toward a solution, develop a presentation and write a final report.

"Modeling these phenomena incorporates aspects of differential equations, combinatorics, probability and statistics, abstract algebra, control theory and numerical analysis," said Ralph Smith, professor of mathematics. "But in addition to using their mathematical skills, the students benefit by learning to work in a team environment, which they must do when faced with interdisciplinary situations in a work environment."

Some projects actually serve as catalysts for long-term investigations that have led to peer-reviewed papers, PhD dissertations and subsequent employment for students. Student participants may also make decisions about career or graduate school, based on their workshop experiences.

"This has given me a feel for what real applied mathematics is," said one student.

"It's confirmed for me that what I've learned in college is valuable," said another.

The benefits to the companies and agencies are also multi-faceted. In addition to possibly solving their research problems, some organizations also take advantage of the recruitment opportunity provided by direct contact with a pool of talented graduate students.

Some projects initially presented at the workshop have resulted in long-term collaboration between applied mathematicians and statisticians and the participating companies. Several companies have presented projects in multiple years, indicating the value they ascribe to the workshop.

One of the groups that solved their problem at this year's workshop was the sensor group, who found no added benefits of mobile sensors over stationary ones. Being mobile would not make the sensors more effective.

"The students actually confirmed our findings," said Michael Horton of Lincoln Laboratory. "But we wanted a fresh perspective, which is why we came here. We wanted to let them run, and they went somewhere we hadn't been. Their findings will help put an exclamation point on our own."

*"These problems are very complex versions of the 'word problems' you may remember from your grade school math classes."*

— Negash Medhin

supported through the years by the National Science Foundation, National Security Agency and now the Statistical and Applied Mathematical Sciences Institute (SAMS).

The workshop exposes graduate and advanced undergraduate students in mathematics, statistics and engineering to challenging problems arising in industrial and government laboratory research. Organizations presenting problems at the 2004 workshop included the MIT Lincoln Laboratory, Calabazas Creek Research, Inc., Jet Propulsion Laboratory, CIIT

and to factor this in with other parameters such as wind speed, plume dispersion and such, to develop an effective system.

Another student group helped CIIT Centers for Health Research in calculating risk for human exposure to inhaled toxins. Since researchers cannot experiment with toxins on humans, they must use lab rats.

However, a rat will not breathe in and breathe out on command. The students modeled the dynamics of how a rat normally breathes by measuring changes in humidity and

# Couple makes a difference by funding scholarship

When one hears the life story of Robert Hill and Linda Balfour, it becomes clear that these two were destined to meet.

Linda grew up on a ranch in east central Texas. Third in her high school class, Linda earned a scholarship and later graduated from Southwestern University in 1966 with a bachelor of business administration.

Her husband chose to do his doctoral work at NC State, where he earned a PhD in agricultural economics and statistics. When the pair moved to Raleigh, Linda took a job

early vacuum tube computers that were part of the nation's early warning system.

"It didn't have the power of a calculator," Robert laughed.

Robert later worked for a manufacturer of computer tape. He was successful there, but soon reached a point where further advancement required a college degree.

With funding through the Veterans Administration (VA) vocational rehabilitation program, Robert entered NC State with the goal of a nuclear engineering degree. He did well with his engineering courses, but he fell in love with computer programming.

After the VA approved a switch of major, Robert dove into computer science, graduating ahead of schedule in 1971.

Robert was then hired at UNC-Wilmington as a systems analyst. One of his duties was to send data to the central office of the University of North Carolina System—to Linda Balfour.

Linda was the editor of the *Statistical Abstract of Higher Education in North Carolina* for the Board of Higher Education and, after the merger of the UNC system in 1972, for the UNC General Administration from 1968–1999.

Robert and Linda finally met face-to-face when a group of UNC staff members met with him when he was offered a position with UNC General Administration in 1974. He would later become the director of information systems for the UNC system.

A few years later, Robert divorced his first wife and then found a friend in Linda, who had also been divorced. They later married, and have lived happily ever since. Now both retired, they enjoy a variety of interests, including traveling to see national ice skating competitions.

Robert and Linda always recognized and appreciated the impact their scholarships had on their lives and careers. Without that financial support, it is likely that neither one would have ever attended college.

Over the years, the two had given

regularly to support NC State. Then in 2002, they were invited to attend the College of Physical and Mathematical Sciences' Realizing Possibilities Dinner. This annual event allows scholarship recipients an opportunity to publicly thank their donors, and for the donors to see what a difference their investment has made.

"It triggered our interest in sponsoring a scholarship," Robert said. "We thought we couldn't, but we wanted to. We thought you had to have \$100,000, or even \$500,000. Then we found out it didn't cost that much, and you didn't have to do it all at once."

It only takes \$25,000 to endow a \$1,000 annual scholarship, and often donors choose to split up their financial pledge over five years. Payments can be made in cash, stock or other resources. There also are many tax benefits available for donors.

Robert and Linda decided to endow a scholarship fund, making their contributions over time.

"We made part of our gift with appreciated stock," Robert said. "By doing that instead of selling it first, we were not subject to capital gains taxes."

A scholarship cannot be awarded until its fund is fully endowed. Robert and Linda saw an opportunity to accelerate the endowment process due to a run of good luck.

"We took advantage of some windfalls," Linda said. "We'd sold some land, inherited some royalties to gas and oil interests in Texas, and had good luck with some stocks."

"We thought we'd speed things along," Robert said. "There are kids out there who need the money now."

The Linda Balfour and Robert Hill Scholarship has been designated to benefit students in PAMS, and is not major-specific.

"They may not know who we are, but we'll know we're making a difference in their lives," Linda said. "We may help a student go to college, or stay in college. We're looking forward to helping someone who needs the help."



Linda Balfour and Robert Hill

with the Board of Higher Education, where she handled student data. Linda would walk in a nearby neighborhood for exercise during her lunch break—the same neighborhood where Robert Hill lived.

Robert was pursuing a BS degree in computer science. He had been raised in rural Randolph County in a large family of modest means. He wanted to go to college but couldn't afford it, so he went into the Air Force instead. He was in the Air Force for a short time, where he worked on the



# Science House challenge grant raises \$500,000

Due to the generosity of an anonymous donor willing to match others' contributions, the PAMS Foundation has raised \$500,000 in endowment for The Science House.

"This challenge grant encouraged many supporters, including some first-time donors, to double the impact of their contribution," said Anita Stallings, executive director of the PAMS Foundation.

Endowment will provide ongoing financial support for The Science House, an important outreach program dedicated to enhancing K-12 education in science and mathematics. The Science House serves about 3,000 teachers and 20,000 students across the state each year.

Despite its achievements and national reputation as a model program, The Science House depends on competitive grants for most of its funding.

"Endowment funds are necessary to provide funding to fill the gaps between grant cycles, which ensures that The Science House can continue fulfilling its mission," Stallings said.

The challenge grant facilitated

establishment of the Charles and Margie Case, Wesley O. Doggett, Robert A. Eason, Elizabeth B. Flynt, Mary and Kermit Freeman Memorial, Gordon Family, Christine Hemrick, Barbara King Hubbard, McHugh-

Haase Family, Connie W. Moreadith, Doris and Rush Thompson and the Goudes endowments for The Science House. Many other donors contributed to a general endowment for The Science House.



**This may look like simple, ooey-goey fun, but hands-on activities like this provide outstanding learning opportunities. The Science House is a national model in K-12 science and mathematics outreach.**

## Duke Energy Foundation supports polymer research at NC State

Duke Energy Foundation of Charlotte, NC, has contributed \$125,000 on behalf of Duke Power to the Department of Chemistry for polymer research.

"The gift reflects Duke Power's support of research into technologies that promise a significant impact on North Carolina's economic growth and development," said Dean Daniel L. Solomon.

Polymer research is one area in which such economic impacts can be made. Potential uses of new polymers vary widely and include everything from biodegradable plastics to drug

delivery vehicles to skin-graft replacements. Polymers also can replace many such materials developed from petroleum products, reducing society's dependence on oil.

Shifts in global economic trends and legislation have negatively impacted the state's once-thriving textile and tobacco industries, and new sustainable outlets for agricultural and oceanic resources need to be developed. Polymers can be produced with "biomass" sources from the ocean and agriculture, making for a perfect match of resources and opportunity for North Carolina.

Duke Power's gift will support the work of the university's Polymer Science Research Cooperative, a group of multidisciplinary scientists led by Dr. Bruce M. Novak. This group is investigating the assembly of polymers from biomass sources, and the potential of these polymers to be competitive with petroleum products.

Duke Power, a business unit of Duke Energy, is one of the nation's largest electric utilities and provides electricity and other products and services to more than two million customers in the Carolinas.

## Alumni/ Student Notables

**Eric Bigham** (BS Chemistry '69) was elected the District IV representative to the American Chemical Society board of directors.

**Martha Gardner** (PhD Statistics '97) was selected by MIT's *Technology Review Magazine* as one of the world's top 100 young innovators.

# Physics professor Dale Sayers memorialized

Family and friends of Dale Edward Sayers have established a fund in his memory. Sayers, professor of physics at NC State, died Nov. 25, 2004, following an unexpected illness.

Sayers earned his Bachelor's degree from the University of California at Berkeley and his Master's and PhD at the University of Washington. He joined the North Carolina State University physics faculty in 1976.

His research centered on the development of a new analytical technique, extended x-ray absorption fine structure, or EXAFS. His work opened a new field of research and led to the formation of the International XAFS Society, which completed its 12th bi-annual meeting in Sweden in 2003.

Recently, he was affiliated with a team that discovered a new x-ray technique, called diffraction-enhanced imaging, that may become a new tool for mammography, osteoarthritis investigations and bone density studies.

Sayers earned a number of national and international awards

including the Bertram Warren Award of the American Crystallographic Association and the Centennial Scholar Award of Case Western Reserve University.

Recently, he received the Outstanding Achievement Award of the International XAFS Society. The award was presented as a career achievement honor.

At NC State, Sayers was honored with the University Libraries Faculty Award and the Alumni Association's Outstanding Research Award. He was a Fellow of the American Physical Society, and held positions as visiting professor/scientist at several international institutions.

Although his vision in scientific and administrative matters was broad, his genius lay in his ability to implement strategies and projects on a level that was responsive to immediate needs. His personal integrity, humor and comfortable communicative style permeated his life, from teaching to heading world-renowned research teams.



Dale E. Sayers

Memorial contributions may be made to the Dale E. Sayers Fund, c/o PAMS Foundation, Campus Box 8201, NC State, Raleigh, NC 27695. The fund will support a graduate student award at NC State, and an international award for young scientists, to be presented by the International XAFS Society. The Sayers family will be notified of contributions made to the fund.

## PAMS Foundation announces new board members

The North Carolina State University Physical and Mathematical Sciences (PAMS) Foundation board of directors recently announced newly elected members.

New directors are Rob Lindberg, director of technology development for the NC Biotechnology Center, RTP; Catherine Sigal (BS Chemistry, '76), retired director of international research for Juvenile Diabetes Research Foundation, New York; Glen Williams, vice president of manufacturing and general manager, Biogen Idec, RTP; and Miriam Zietlow, market manager—auto coatings and electronics, Lord Corporation, Cary.

Directors elected to additional terms are Stephen Frye (BS Chemistry,

'83), worldwide head of high throughput chemistry, GlaxoSmithKline, RTP; Charles Joyner (BS Chemistry, '71, MA Economics, '84), attorney, Bahama; Michael Peirson (PhD Marine, Earth and Atmospheric Sciences, '83), president, Cherrystone Aqua-Farms, Eastville, Virginia; and Meredith Williams (PhD Physics, '94), product line manager, Applied Materials, Sunnyvale, California.

The mission of the PAMS Foundation is to promote the educational, research and service programs of the College of Physical and Mathematical Sciences through personal advocacy by the board of directors and by securing private funding for priority programs of the college.

## Got news?

If you'd like to report recent achievements or other important news about yourself or your fellow alumni, or just want to update us on how you're doing, e-mail us at [pamsalumni@lists.ncsu.edu](mailto:pamsalumni@lists.ncsu.edu). We'd love to hear from you!

## Want news?

If you'd like to be among the first to hear PAMS news and announcements, then sign up for *PAMS Focus*, our electronic newsletter. Just contact us at [pamsalumni@lists.ncsu.edu](mailto:pamsalumni@lists.ncsu.edu). We'll need your name, class year, degree, address, phone and e-mail address to add you to our distribution database.



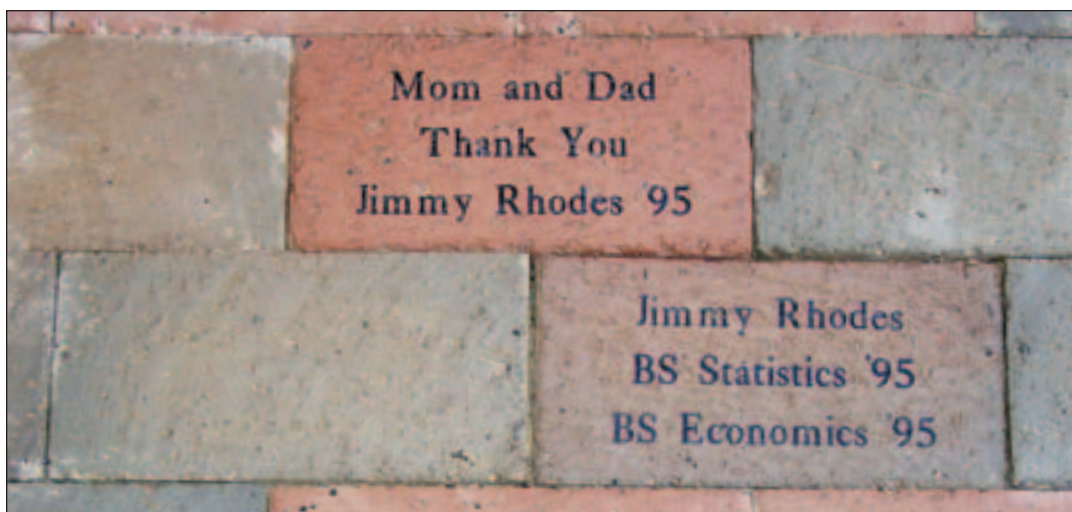


PHOTO BY SALLY HANEY

## How to make a gift

Many alumni remember how difficult it was to manage the expense of higher education and want to find a way to help today's students achieve their dreams.

The PAMS Foundation provides many ways to support students, faculty and programs of the College. Whether you want to contribute to an existing scholarship, support a departmental enhancement fund, make a memorial gift, or consider more significant support, our staff is available to help you explore the options.

## Add your name to the Walk of Discovery

Now that the first installation of engraved bricks has been placed in the Walk of Discovery, visitors to campus can see the names permanently etched into NC State's history.

Located near the entrance of the Marye Anne Fox Undergraduate Science Teaching Laboratory, the Walk of Discovery features laser-

engraved bricks bearing the names of alumni, faculty, students and friends. Each has contributed \$100 to support PAMS scholarship funds in exchange for an engraved brick.

If you would like us to install a brick in the Walk of Discovery in your name, or in honor of a loved one, contact the PAMS Development

Office at 919-515-3462 and we will mail or fax an order form to you. We can accept orders by fax with credit card information.

Bricks must be engraved in lots of 100 and we are currently collecting orders for the next lot. You will be notified when your lot has been installed.

### To support existing funds

To contribute to a scholarship, fellowship or other fund, simply mail a check to the NC State Physical & Mathematical Sciences Foundation, Campus Box 8201, Raleigh, NC, 27695. Make checks payable to PAMS Foundation and write the name of the fund on the "notes" or "for" line.

If your employer provides matches for charitable donations, please send a completed matching gift form with your contribution.

There are many funds not mentioned in this issue of *Scope*, and several have specific designated uses. If you would like information on our various funds to help you decide the best fit for your support, please give us a call at 919-515-3462. For a list of funds, visit [www.pams.ncsu.edu/development/funds.php](http://www.pams.ncsu.edu/development/funds.php).

### To explore other options

If you have questions about gift planning, we can help you identify tax benefits, choose between permanent endowment vs. one-time support, and explore estate planning or life-income options.

There are many ways to match your interests with specific College needs, and several possibilities for making your vision a reality. Whether using cash, appreciated assets, real estate or a bequest, we can help you find the best way to make the most of your gift.

Contact us today at 919-515-3462 or by e-mail at [pamsalumni@lists.ncsu.edu](mailto:pamsalumni@lists.ncsu.edu).

## WIN TICKETS FOR THE BIG GAME!

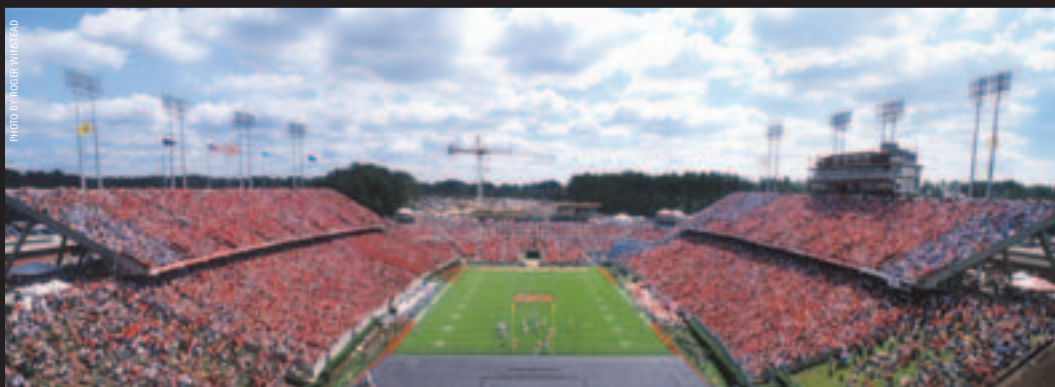


PHOTO BY KAREN WINTERBOD

### Can't get tickets for the NC State-Carolina game on Sept. 24?

Register to win two tickets for the game by e-mailing us at [pamsalumni@lists.ncsu.edu](mailto:pamsalumni@lists.ncsu.edu). Only PAMS alumni are eligible, so please provide your name (include maiden name), class year, address and phone number.

We will draw the winner's name and alert them on June 1.

# Happy 400th!

The most recent observed supernova in the Milky Way Galaxy, Kepler's Supernova is important to astronomers interested in how stars explode and the resulting creation of heavy elements like iron and gold, production of energetic cosmic ray particles, and perhaps even the formation of new stars. A team of researchers, including NC State physicist Stephen P. Reynolds and Kazimierz Borkowski, recently marked the 400th anniversary of this celestial event with a detailed observation by the Spitzer Space Telescope, a new NASA satellite detecting infrared (heat) radiation. Borkowski's work on dust formation and destruction in supernova remnants may reveal more detail about conditions in the supernova remnant's expanding gas, and may help settle a long controversy about the nature of the star that exploded.

Reynolds is interested in the generation of cosmic rays, and the infrared data may provide clues there as well. In this image, x-rays are blue and green, infrared light is red, and visible light is yellow.

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**achieve!**  
Innovation in Action

NASA, ESA, R.SANKRIT AND W. BLAIR (JOHNS HOPKINS UNIVERSITY). IMAGES CAPTURED BY HUBBLE AND SPITZER SPACE TELESCOPES AND CHANDRA X-RAY OBSERVATORY.

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Scope is published by the College twice per year

*Dean* Daniel L. Solomon

*Editor* Anita Stallings

*Writer* Sally Ramey

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Mick Kulikowski and Tracey Peake

*Design* Zubigraphics

11,000 copies of this public document were printed at a cost of \$6,265.00 or 56¢ per copy.

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